

SECTION 94

ELECTRONIC NAVIGATION EQUIPMENT

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94.1 REFERENCES

(94A) Code of Federal Regulations - 46 CFR Sub-chapter J

94.2 INTRODUCTION

This Section sets forth the Contractor Design and Provide general requirements for the electronic navigation equipment and an Automatic Draft Indicator System.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

94.3 GENERAL

The Contractor shall provide all equipment cited herein and otherwise required by the Authoritative Agencies.

- 1 • Provide dual radar scanner units on each End of the Vessel with raster displays, and
2 Global Positioning System (GPS) with inputs to radars for ARPA/radar to aid
3 collision avoidance capabilities.
- 4 • Provide steering controls, alarms and indicators to permit independent steering of
5 each rudder from each Pilothouse, and interface with the Owner Furnished
6 Equipment (OFE) AMS System. See Section 81 of the Technical Specification for
7 Steering Control and Alarm System requirements.
- 8 • Provide a Rudder Angle Indicator system in the EOS, each Steering Gear Room, and
9 each Pilothouse, and interface with the OFE AMS System. See Section 81 of the
10 Technical Specification for Steering Control and Alarm System requirements.
- 11 • Provide a Gyrocompass System.
- 12 • Provide a Universal Automatic Identification System (UAIS) tied into the
13 gyrocompass system.
- 14 • Provide a Satellite Compass System.
- 15 • Provide a Wind Speed and Direction Sensing and Indicator System.
- 16 • Provide a Automatic Draft Indication System (ADIS).
- 17 • Provide a Global Positioning System.
- 18 • Provide a Voyage Data Recorder System.

19 Circuits, systems, and equipment in **TABLE 94-1** below shall include:

TABLE 94-1 Circuit Systems	
Circuit	Equipment
R-ES	Radars
1L & 2L	Steering Control Systems
LA1 & LA2	Steering Gear Alarms
LA3 & LA4	Steering Failure Alarms
1N & 2N	Rudder Angle Indicator Systems
LC	Gyrocompass System
R-LC	Satellite Compass System
HD & HE	Wind Speed & Direction
AIS	Universal Automatic Identification System
R-SS	Automatic Draft Indication System
R-GP	Global Positioning System

Each item of equipment shall be installed according to its manufacturer's recommended installation. Installations shall be designed and installed in a manner that avoids both physical and electromagnetic interference. The particular devices shall be chosen to maximize their integration among themselves and other Vessel's systems.

NOTE: Attention to all antenna locations shall include environmental, security, safety, and aesthetic concerns to the design. All antenna locations shall be approved by the WSF Representative and presented on a single drawing. WSF Drawing No. 8301-661-094-01 (*latest revision*) represents an antenna arrangement for the M/V ISSAQUAH amplifying the methodology acceptable to WSF. See Phase III drawing requirements in Section 100 of the Technical Specification.

For cable installation, identification and termination, see Section 87 of the Technical Specification. See Section 100 of the Technical Specification for final testing requirements.

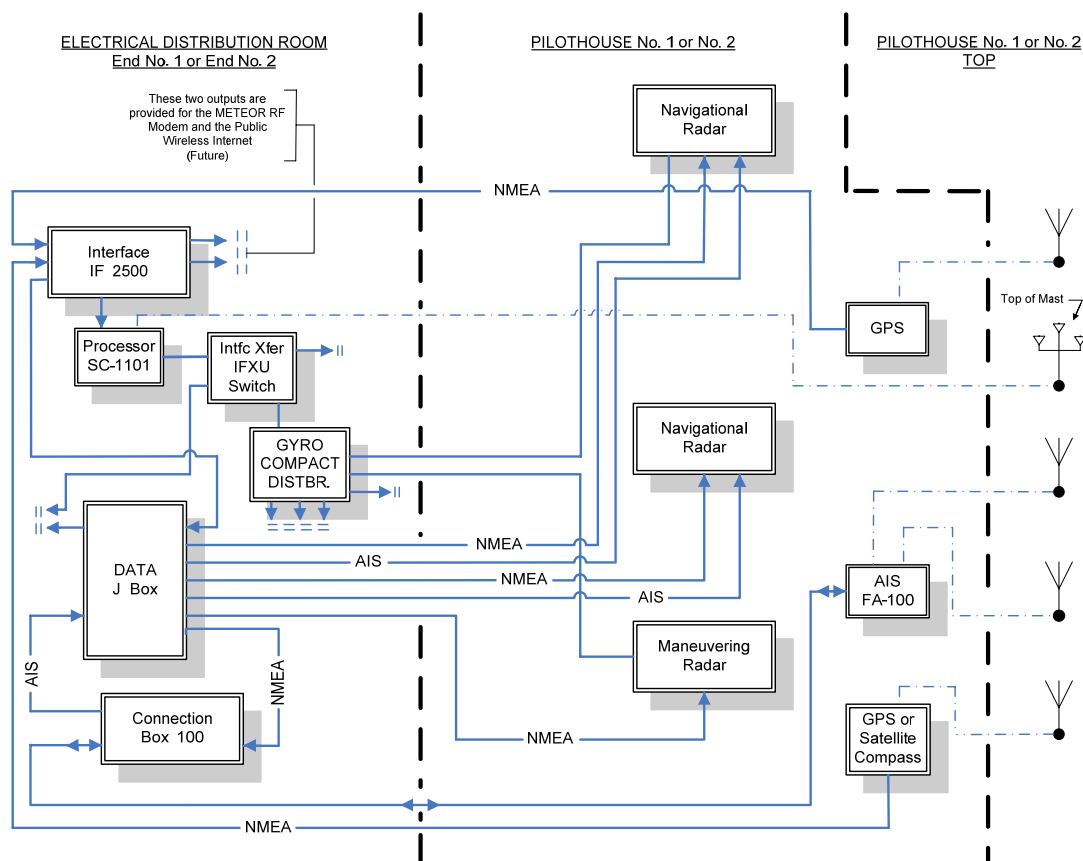
The Contractor is advised that it is wholly responsible for ensuring that the design and installation of Navigation System equipment is complete and adequate for the service intended and that they comply with Reference (94A), and 46 CFR §62. Specific references to some Vessel equipment are intended to define WSF requirements that supplement the requirements of the Authoritative Agencies.

Provide “BLACK” phenolic nameplates with “WHITE” lettering on all enclosures. Lettering shall be at least $\frac{3}{8}$ inch high and in accordance with the requirements of Section 24 of the Technical Specification for phenolic nameplates.

See the *Antenna Identification Nameplates* Subsection of Section 24 of the Technical Specification.

94.4 ELECTRONIC NAVIGATION EQUIPMENT ARCHITECTURE

The below matrix illuminates WSF Fleet-wide Standardized system architecture for certain electronic navigation equipment.



The Contractor shall provide an interconnected electronic navigation equipment system design that meets the requirements of the above architectural matrix. WSF Drawing No. 8301-661-094-03 (*latest revision*) represents an electronic navigation equipment electronic data wiring diagram for the M/V ISSAQUAH amplifying and updating the methodology acceptable to WSF.

1 **94.5 COMPASSES**

2 Section 15 of the Technical Specification contains the magnetic compass requirements.

3 The gyrocompass and satellite compass certified technical representatives, and a Contractor
4 provided certified compass adjuster shall be present during Sea Trials to perform final
5 calibration, and to make any adjustments required.

6 **94.5.1 Gyrocompass**

7 **NOTE:** *WSF is currently participating in a test program with the USCG to*
8 *determining if the new satellite compass system installations can*
9 *operationally replace the installation of the current gyrocompass*
10 *systems onboard WSF Vessels. This is an ongoing test program and*
11 *may eliminate a need to install gyrocompass systems onboard the new*
12 *Vessels. Therefore, each proposer shall provide the installation of the*
13 *gyrocompass system as a separate line item in his bid that can be easily*
14 *removed from the bid if by the time the Contract is awarded, the satellite*
15 *compass system has been approved by the USCG as a replacement for*
16 *the gyrocompass system and WSF decides to exercise that option.*

17 Provide a gyrocompass system with both step and sync outputs including binnacle, power
18 supply, alarms and associated equipment and two (2) repeaters. Locate the gyrocompass
19 and power supply in general agreement with Phase II Design direction given by the WSF
20 Representative for Pilothouse arrangements. For WSF Fleet-wide Standardization
21 purposes, the gyrocompass system shall be an ANSCHUTZ Standard 20 Gyrocompass
22 with Speed Error Correction Operator (SECOP), repeaters, Compact Distributor, and
23 power interrupt switch.

24 Provide all necessary interfaces to the four (4) radar sets described in this Technical
25 Specification. Provide two (2) gyro repeaters, one (1) installed in each Pilothouse. One
26 (1) repeater shall be installed in each Pilothouse Control Console . The gyrocompass,
27 transmission unit, SECOP, compact distributor, interrupt switch, and repeaters shall be
28 from the same manufacturer.

29 The gyrocompass shall have provisions for maintaining electrical supply during
30 temporary power interruptions. Provide a gyro power failure alarm circuit. All

Pilothouse alarms are to silence automatically in two (2) minutes for unmanned Pilothouse during daily tie-up periods.

A dimmable, lighted digital display of the gyrocompass heading at each main steering station shall be provided. The digital display shall be clearly marked indicating the Vessel gyro heading.

Provide foundations, local interconnecting cables, power cable and leads, and other items and devices as are required to make a complete, functional and fully operational interconnection to the alarm panels and gyro repeaters.

Provide the services of a manufacturer's certified technical representative for initial start-up, installation testing, calibration, adjustment, and operator familiarization.

94.5.2 Satellite Compasses

For WSF Fleet-wide Standardization purposes, provide all equipment, cabling and hardware required to produce two (2) complete, functional and fully operational FURUNO ELECTRIC CO., LTD. SC 110 Satellite Compass Systems, with process units, display units, repeater displays, and rigid support SC-1203F tri-antenna systems for No.1 Pilothouse with the repeater display in No. 2 Pilothouse, and a second unit in Pilothouse No. 2 with the repeater display in Pilothouse No. 1.. The Satellite Compasses shall be capable of providing accurate position information, while also providing precision heading information to radar/ARPA.

Provide all necessary interfaces to the navigational radar sets as described in this Technical Specification.

NOTE: Provide clear area all around antenna in accordance with manufacture's specifications.

Provide the services of a manufacturer's certified technical representative for initial start-up, installation testing, calibration, adjustment, and operator familiarization.

94.6 GLOBAL POSITIONING SYSTEMS

For WSF Fleet-wide Standardization purposes, provide all equipment, cabling and hardware required to produce a complete, functional and fully operational FURUNO ELECTRIC CO., LTD. GP-90D Global Positioning System(GPS) for each Pilothouse. The GPS shall be capable of providing accurate position information while interconnected with the Radars. The GPS shall be powered from the Pilothouse 24 Vdc Navigation Power Panel.

1 Provide full interface with the GPS System as set forth in the *RADAR SYSTEMS* and
2 *UNIVERSAL AUTOMATIC IDENTIFICATION SYSTEM* Subsections in this Technical
3 Specification.

4 Provide the services of a manufacturer's certified technical representative for initial start-up,
5 installation testing, calibration, adjustment, and operator familiarization. The GPS
6 manufacturer's certified technical representative shall be present during Sea Trials to
7 perform final calibration, and to make any adjustments required.

8 **94.7 RADAR SYSTEMS**

9 **94.7.1 Navigational Radar**

10 For WSF Fleet-wide Standardization purposes, provide four (4) FURUNO ELECTRIC CO.,
11 LTD. Model FR-2127, flat screen radars, (two (2) in each Pilothouse) with all required cable,
12 connectors, hangers, foundations, antennas, power supplies, junction boxes, cable, and all
13 required materials interfaced with a Contractor provided FURUNO FA-100S Universal
14 Automatic Identification System (UAIS) system and the above mentioned FURUNO
15 ELECTRIC CO., LTD. GP-90D GPS system to deliver a fully interfaced and operational
16 navigation/locator system. Each radar system shall be fully ARPA/radar to aid collision
17 avoidance equipped with integrated chart display and be in full compliance with USCG
18 requirements.

19 Locate display units, power supplies, and gyrocompass input in general agreement with the
20 Phase II design direction given by WSF for Pilothouse arrangements.

21 Two (2) complete radar sets shall be provided on each End of the Vessel. These two (2)
22 systems shall be **totally redundant** and identical in every way except location of the scanner
23 units and display units.

24 Mount the display units at a height that places the center of the display screen forty-four
25 (44) inches above the surface of the deck with the screen at an angle of forty-three
26 (43) degrees above the horizontal.

27 Cable routing between the antenna array and the display unit, as well as between the power
28 panel and the display, shall maximize the distance between cable and the magnetic
29 compasses located on the steering stands in each Pilothouse.

30 Provide the services of manufacturer's certified technical representatives for initial start-up,
31 installation testing, calibration, adjustment, and operator familiarization. The navigational
32 radar certified technical representative shall be present during Sea Trials to perform final
33 calibration, and to make any adjustments required.

94.7.2 Maneuvering Radar

For WSF Fleet-wide Standardization purposes provide two (2) FURUNO Model 1832 repeater radars (one (1) in each Pilothouse) to be mounted on a swivel base on the Pilothouse Control Console in a location designated by WSF Representative. Provide all required cables, connectors and other required materials to interface the maneuvering radars with one (1) of the FURUNO Model FR-2127 navigational radars.

Cable routing between the antenna array and the display unit, as well as between the power panel and the display, shall maximize the distance between cable and the magnetic compasses located on the steering stands in each Pilothouse.

Provide the services of manufacturer's certified technical representatives for initial start-up, installation testing, calibration, adjustment, and operator familiarization. The maneuvering radar certified technical representative shall be present during Sea Trials to perform final calibration, and to make any adjustments required.

94.8 WIND SPEED AND DIRECTION SYSTEMS

Provide all equipment, cabling and hardware required to produce a complete, functional and fully operational MALLING System 879, or equal, wind measurement system for each Pilothouse. Each wind measurement system shall be capable of providing accurate true wind speed and direction.

Provide the services of a manufacturer's certified technical representative for initial start-up, installation testing, calibration, adjustment, and operator familiarization.

94.9 UNIVERSAL AUTOMATIC IDENTIFICATION SYSTEM (UAIS)

For WSF Fleet-wide Standardization purposes, provide all equipment, foundations, cabling and hardware required to produce a complete, functional and fully operational FURUNO FA-100S Universal Automatic Identification System (UAIS) system. The system shall be tied to and interface with the gyrocompass and GPS systems as set forth in the *RADAR SYSTEMS* Subsection in this Section of the Technical Specification.

For generic system methodology for a WSF UAIS system, the Contractor shall refer to WSF Drawing No. 8300-624-094-01 (latest revision), depicting an ISSAQUAH Class Ferry installation.

94.10 AUTOMATIC DRAFT INDICATION SYSTEM (ADIS™)

For WSF Fleet-wide Standardization purposes, provide all equipment, foundations, cabling and hardware required to produce a complete, functional and fully operational Automatic

Draft Indication System (ADIS™), WEIR-JONES ENGINEERING, LTD. for each Pilothouse. The system shall indicate continuous fore/aft draft readings at the following stations: both Pilothouses (CRT system displayed). The ADIS™ system shall be designed installed in general accordance with WSF Drawings No. 8305-607-095-01, *Automatic Draft Indication System (ADIS) Electrical Installation* (latest revision), and No. 8305-607-002-01, *Automatic Draft Indication Hull Installation* (latest revision) as guidance, and meet all the requirements of the manufacturer.

Provide the services of a manufacturer's certified technical representative for initial start-up, installation testing, calibration, adjustment, and operator familiarization. See Section 100 of the Technical Specification. The ADIS™ certified technical representative shall be present during Dock Trials, as necessary, to perform final calibration, and to make any adjustments required.

94.11 STEERING CONTROL SYSTEMS

Provide two (2) independent top rudder stock actuator type rotary hydraulic coupling Steering Gear Steering Control Systems as set forth in Section 81 of the Technical Specification. The system and installation shall comply with all requirements of 46 CFR.

Excepting the electrical cables and some interconnecting piping necessary for hydraulic oil transfer between the hydraulic oil reservoir and fixed storage tank, installation connections, and alarm annunciators and indicators in the Pilothouses and EOS Control Consoles; the Steering Gear, rudder, and steering control/monitoring systems shall be purchased as a package from one (1) vendor, with all components fabricated, assembled, painted, pre-wired and tested by the manufacturer, ready for installation by the Shipyard. The same steering system vendor shall have a service facility and field representatives in the Puget Sound area of Washington State on a permanent basis for service and parts.

This Class of Vessel shall have dual Steering Gear Systems on each End of the Vessel. Each Steering Gear System shall have two (2) pumps, two (2) variable frequency drive motor controllers on each End of the Vessel. One (1) motor, motor controller, and control system on each End of the Vessel shall be fed directly from the Emergency Switchboard. The other motor and controls on each End shall be fed directly from the Ship's Service Switchboard. Wiring for the two (2) steering systems shall be installed physically as far apart as practical. See 46 CFR §111.

Any of the four (4) systems shall be selectable from switches provided in the EOS and Pilothouse Steering Control panels.

The steering control systems shall be supplied as an integrated system and configured to operate with the Steering Gear machinery described in Section 81 of the Technical Specification.

Mount the steering controls in the EOS and Pilothouse Control Consoles as approved by the WSF Representative for Pilothouse and EOS arrangements.

Enclosures for electrical equipment shall be NEMA 12 with provision for watertight stuffing tube cable entrances.

Electrical connections shall be on screwed terminals with floaters and labels on each connection and shall meet all requirements of Section 87 of the Technical Specification unless directed otherwise in this Section.

Upon completion of the installation, provide the services of a manufacturer's certified technical service representative for initial start-up, installation testing, adjustment, and operator familiarization. The manufacturer's certified technical representative shall be present during Sea Trials to perform final calibration and to make adjustments as required.

94.12 STEERING GEAR ALARM SYSTEM

Provide a Steering Gear Alarm System, integrated with the Steering Gear System specified in Section 81 of the Technical Specification, that complies with 46 CFR §111, including electric power, display units, senders, sensors, wiring, connectors, hangers, switches, and other items and devices as required to make a complete, functional, and fully operational alarm system for each Steering Gear System.

Provide all Steering Gear System alarm point outputs to the Vessel's OFE Alarm & Monitoring System for display in the EOS.

Display the Pilothouse alarm functions using light emitting diodes (LEDs) in the control panel (supplied with the steering gear specified in Section 81 of the Technical Specification) located in each Pilothouse.

The alarm silence function in the Pilothouse shall be separate from the EOS alarm silence & clear.

The alarms system shall be fully integrated with the Steering Gear System.

94.13 STEERING FULL FOLLOW UP (FFU) FAILURE ALARM

Provide a Steering FFU Failure Alarm System integrated with the *ROTARY STEERING GEAR AND STEERING SYSTEMS* Subsection equipment in Section 81 of the Technical Specification, which complies with 46 CFR §111, including, electric power, display units, senders, wiring, connectors, hangers, switches, and other items and devices as required to make a complete, functional, and fully operational Steering Failure Alarm System duplicating that installed in other classes of WSF Vessels. The Steering FFU Failure Alarm System shall be fully integrated with the steering control system.

1 The Steering FFU Failure Alarm System shall be independent of, and isolated from, the
2 steering gear alarm system.

3 The Steering Failure Alarm shall be designed to alarm when the Steering Failure Alarm
4 conditions given in 46 CFR §113 are met, regardless of which rudder is being used for
5 primary steerage, and which steering system is in use on each End of the Vessel.

6 Locate Steering Failure Alarm Indicator Panels in each Pilothouse.

7 Electric power for the Steering Failure Alarm System shall be provided from the final
8 emergency power panel located in general agreement with the Electrical One-Line Diagram.
9 The FFU alarm output shall be inactive when placed in the Non Follow Up (NFU) position.

10 **94.14 RUDDER ANGLE INDICATOR SYSTEM**

11 Provide a Rudder Angle Indicator (RAI) system (some components provided in Sections 2
12 and 81 of the Technical Specification) for each rudder, which complies with 46 CFR §111,
13 including, electric power, display units, senders, wiring, connectors, hangers, switches, and
14 other items and devices as required to make a complete, functional, and fully operational
15 rudder angle indicating system. The dimmers for the bulkhead mounted rudder angle
16 indicators in each Pilothouse shall be located in each Pilothouse Control Console. The
17 Rudder Angle Indicator System shall be independent of the steering control and steering gear
18 System, and Steering Failure Alarm System.

19 Provide electric power from the final emergency power system. Upon completion of the
20 installation, provide the services of a certified manufacturer's technical representative for
21 initial start-up, installation testing, calibration, adjustment, and operator familiarization. The
22 certified RAI manufacturer's technical representative shall be present during Sea Trials to
23 perform final calibration and to make any adjustments required.

24 **94.15 SPARE PARTS AND INSTRUCTION MANUALS**

25 Provide a list of recommended spare parts and special tools for those items which are
26 Contractor furnished, together with parts lists and instruction manuals necessary to maintain
27 and service provided equipment and accessories in accordance with the requirements of
28 Sections 86 and 100 of the Technical Specification.

29 **94.16 TESTS, TRIALS AND INSPECTIONS**

30 Tests and/or Trials shall be in accordance with this Section and Section 101 of the Technical
31 Specification.

1 Inspections shall be performed as defined in this Section and in Sections 1 and 2 of the
2 Technical Specification.

3 **94.17 PHASE II TECHNICAL PROPOSAL REQUIREMENTS**

4 The following deliverables, in addition to other deliverables required by Section 100 of the
5 Technical Specification and the Authoritative Agencies, shall be provided during the Phase II
6 Technical Proposal stage of Work in accordance with the requirements of Section 100 of the
7 Technical Specification:

8 A. Electronic Navigation Equipment List

9 B. Automatic Draft Indicator System (ADIS) Report

10 The *Automatic Draft Indicator System (ADIS) Report* shall fully describe the draft indicator
11 system to be installed. The report shall include appropriate vendor supplied information
12 relating characteristics of the system components.

13 See Section 100 of the Technical Specification for additional requirements regarding
14 technical documentation.

15 **94.18 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS**

16 The deliverables required by Section 100 of the Technical Specification and the
17 Authoritative Agencies, shall be provided during the Phase III Detail Design stage of Work
18 in accordance with the requirements of Section 100 of the Technical Specification.

19 See Section 100 of the Technical Specification for requirements regarding technical
20 documentation.

(END OF SECTION)